The magnetic effect as a result of the speed dependent alteration of the electrical field. (The angle φ of the electrical field.)

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Abstract: I describe or explain the emergence of the magnetic effect on a new way. To this only the electrical field and the constancy of the speed of light are needed. I show, in which way the electrical field changes when the field producing charge moves with a velocity. The magnetic effect arises from this change in a very simple way. The magnetic effect can be calculated very easily here. In this description, the magnetic effect still remains dependent on the observer. The transformations between inertial systems are carried out just normally with the special relativity.
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1. Preface/Introduction

It is very well known how to calculate the magnetic effect. The transformations in other reference systems also can be explained very well with the special relativity.
But how does the magnetic effect arise?
Although it is obvious that the magnetic effect is connected with the electrical effect it cannot be recognized how this connection takes place.
I have found a very simple and new way to describe or to explain the emergence of the magnetic effect. To this, I need only and alone the electrical effect, which is regarded as given. The constancy of the speed of light [1] is presupposed.
The electrical field leaves its charge with the speed of light ($\vec{c}$). If one generalizes this, then one can represent the field with the velocity with which it leaves its charge. From this simple approach the magnetic effect arises obviously and mandatorily.
But, of course, there are still some additional conditions which have to be examined more exactly...
To prevent wrong expectations: In this work here, I explain only the emergence of the magnetic effect in dependence of the observer. Hence the magnetic effect still stays velocity dependent. The transformations into other inertial systems are carried out just normally with the special relativity.

2. The strength and the direction of the electrical field

The electrical field of an electrical charge Q leaves this charge with the velocity $\vec{c}$. This can be understood as if the electrical field is produced (arises) continuously (permanent) newly at the place of the charge.
The electrical field has an effect on charges by a force. The strength and the direction of this force depend on the electrical field. Having this dynamic effect (of the force) means that the field transfers energy to charges. The field has an energy-density corresponding to its field-strength.
The field-strength $\vec{W}$ (effect-strength) - said more exactly: the strength and the direction of the field *at its emergence* (at the place of the charge Q) - can be represented by $\vec{c}$ (therefore by the velocity, with which the field leaves of Q). (Figure 1)
So, here, the strength and the direction of the field of a charge are represented at every point of the field by the velocity with which the field leaves at its

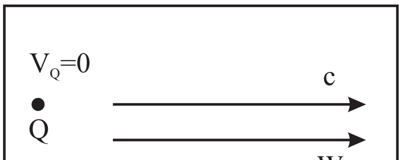

Figure 1

beginning its charge. (Of course, the strength of the field depends on the distance to the charge with $1/r^2$.)
If this is so, then, of course, the velocity $\vec{V}_Q$, with which the field producing charge Q moves, must be taken into account too. When the charge Q moves with the velocity $\vec{V}_Q$, then the strength and the direction, that is the effect of the field ($\vec{W}$), of this charge must change in this representation here by $\vec{V}_Q$.
Said more exactly: If $\vec{W}$ and $\vec{c}$ shall point in the same direction, then the $-\vec{V}_Q$ must be taken for the change of $\vec{W}$ since $\vec{c}$ leaves Q. (Of course, the actual effect-direction depends on the signs of the charges which are just interacting with each other. - To this later more.)
The connections are represented in Figure 2:
If $\vec{V}_Q$ and $\vec{c}$ point in the same direction, then the field leaves its charge more slowly, and therefore it has a smaller effect ($\vec{W}$).
If $\vec{V}_Q$ and $\vec{c}$ point in opposite directions then the effect $\vec{W}$ gets correspondingly bigger.
Vertically to $\vec{V}_Q$, the angle φ results between the propagation-direction of the field (which propagates with $\vec{c}$) and its effect-direction (direction of $\vec{W}$). It is: $\varphi = \arctan \frac{V_Q}{c}$.

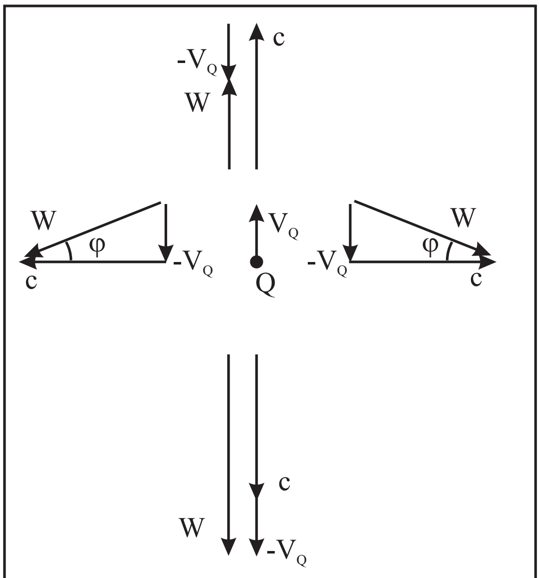

Figure 2

2.1 Quanta

But the strength and the direction of the effect of the field of a charge is *not* allowed to change due to the velocity $\vec{V}_Q$ of the charge.
The problem is solved, if one assumes that the electrical field is quantized [2].
The quanta of the field are emitted evenly in all directions, and in the same intervals.
At first we look at the direction parallel to $\vec{V}_Q$:
If $\vec{V}_Q$ and $\vec{c}$ point in the same direction then the emitted quanta are closer together. Simultaneously the effect $\vec{W}$ of every quantum becomes smaller in the same measure. So, the number of the quanta per distance (that is the density) increases with $\vec{V}_Q$ and at the same time their effect-strength decreases with $\vec{V}_Q$. This compensates each other exactly.
The analogue is valid, if $\vec{V}_Q$ and $\vec{c}$ point in opposite directions. Then the number of the quanta per distance (that is the density) decreases with $\vec{V}_Q$ and their strength increases with $\vec{V}_Q$. This compensates each other exactly too.
So, the field-strength (which corresponds to the energy-density of the field) doesn't change in the direction of $\vec{V}_Q$. Only the quantization of the field changes.
Said differently: the normal electrical effect remains unchanged.
We are looking at the direction vertical to $\vec{V}_Q$ now:
The density of the quanta of the electrical field doesn't change here. But, instead, the direction of the effect changes. Here we have the angle φ between the effect $\vec{W}$ and the propagation-direction (with $\vec{c}$) of the

field. This angle is not compensated by anything and is naturally part of the field of a charge Q which moves with $\vec{V}_Q$.

Since we have $\vec{V}_Q \perp \vec{c}$, the effect-strength doesn't change in the direction of $\vec{c}$. But, an additional effect arises in the direction of $\vec{V}_Q$. The meaning of this additional effect in the direction of $\vec{V}_Q$ is an important component of this work and will get clear in the further course.

2.2 Tension condition

To be able to imagine the connections better, the effect-strength and the effect-direction of the quanta of the electrical field can be explained also as follows:

When a point of the field leaves the charge, a kind of tension condition arises due to the distance which arises between the field-point and the charge. The longer the distance between the field-point and the charge is, all the bigger the tension is also. Since the field is quantized, after the time Δt_0 a new field-point must be taken - which leaves the charge - and which builds up the tension once more. So, one can assign a (one-dimensional) length to a quantum of the electrical field. For $\vec{V}_Q = 0$ this length is $\Delta S_0 = \Delta t_0 * c$. In general we have: $\Delta S = \Delta t_0 * \left(\vec{c} + \vec{V}_Q\right)$.

The bigger ΔS is, all the bigger the tension is also. The quanta of the electrical field always move with $\vec{c}$. So, the bigger ΔS is, all the bigger the time is which passes until such a quantum has passed a point on which it has an effect, too. On the other hand, the number of the quanta which can act (have an effect) on this point (some other charge) gets all the smaller the bigger ΔS becomes. This compensates each other exactly. The bigger the tension of a quantum of the electrical field is, all the longer it is, too, and all the longer it takes until it has acted. One can imagine this effect of the quantum of the electrical field on a charge also as an "absorption" - the larger its length is, the longer its absorption takes, too.

In an analogous way an additional tension condition also arises vertically to $\vec{c}$, if $\vec{V}_Q$ is vertically to $\vec{c}$; or if a $\vec{c}$ which is vertically to $\vec{V}_Q$ is considered. (Of course, it is the same, if a component of $\vec{V}_Q$ which is vertically on $\vec{c}$ is considered.) Here, a resulting effect $\vec{W}$ arises which has the angle φ to $\vec{c}$.

Summarizing, it can be said that the field-strength *doesn't* change by $\vec{V}_Q$ in the direction of $\vec{c}$, and that the angle φ arises between $\vec{W}$ and $\vec{c}$, if $\vec{V}_Q$ has a vertical component on $\vec{c}$.

(Smaller quanta have less *energy* and have instead a greater density (one could say that every quantum has a smaller field-strength but that there are more of them). Altogether, the *strength* of the field remains the same. So it has the same total energy.)

Extra note: In case the field isn't quantized (which means that it can be regarded as homogeneous) one gets a compression or stretching of the field-strength in or contrary to the direction of $\vec{V}_Q$. This could be relevant for greater charge accumulations which move together with grate speed. This isn't relevant for the considerations to be made here, however. Here, it is primarily all about the angle φ.

In the following, special attention will be given on the meaning which the angles φ has when the field has an effect on a charge.

An important note: of course, the velocity $\vec{V}_Q$ depends on the observer. This means that φ depends on the observer too. The transformation in other reference systems is simply carried out via the special relativity.

This seems a little surprising from the everyday view: if one could visualize the angle φ, then two different observers could see respectively different angles (φ) for the same electrical field. Their observations, regarding the angle, wouldn't match. Such differences are already known from the theory of special relativity. In the end they all arise from the constancy of the speed of light. For the angle φ it is exactly so. The speed of light shall be constant here too, of course. Actually, the constancy of the speed of light is one of the most important prerequisites for this concept here. The velocity $\vec{V}_Q$ doesn't influence the $\vec{c}$. Since $\vec{V}_Q$ depends on the observer and $\vec{c}$ doesn't, φ changes inevitably.

3. Anti-field

Because of the angle φ, the effect-direction ($\vec{W}$) of the field changes in respect to its propagation-direction (with $\vec{c}$). An effect vertical to $\vec{c}$ arises. But this can not be.
The problem is solved very simply, if one assumes that, additionally to the field, an anti-field arises while the field acts (has an effect) on a charge. Said more exactly: to every field-quantum an anti-quantum arises.
What is that anti-field?
The anti-field is a field that acts exactly in the opposite direction to the field. In addition, it also moves exactly in the opposite direction. The anti-field has the same field-strength as the field. The angle φ has the same amount, but it is *reflected*, which corresponds to the fact that the anti-field moves in the opposite direction to the field.
When the field acts on a charge E, then the anti-field arises at this charge. Both the field and the anti-field have an effect on the charge E. The anti-field acts exactly in the opposite direction to the field; since it also moves in the opposite direction, it finally (resulting) acts in the same direction as the field.
So, the effect of the field on a charge consists of two components: the one of the field and the one of the anti-field.
Said more exactly: To every field-quantum an anti-quantum arises at E. The effects of the quantum and of the anti-quantum add up to the overall-effect. The anti-quantum of the electrical field absolutely corresponds to an anti-particle [3]. The energy which the field transfers to the charge is the addition of the energy of the field plus the energy of the anti-field, or of the energy of the quantum plus the energy of the anti-quantum. So, the energy of the anti-field is already existing in the energy of the field.

Remark: One can imagine the creation of the anti-field also as a kind of reflection of the field from the charge (E). If the effect of the field corresponds to an absorption, then the reflection corresponds to an emission. The emission corresponds to a repulsion and therefore acts in the same direction as the original field. However, this comparison doesn't always work particularly well.

If, now, we represent the effect of the field or of the field-quanta by $\vec{c}$ again, and if we represent the effect of the anti-field or of the anti-quanta logically by $\vec{c}' = -\vec{c}$ then the overall-effect $\vec{W}_g$ of the electrical field on a resting charge E ($\vec{V}_E = 0$), when $\varphi = 0$, is $\vec{W}_g = \vec{c} - (-\vec{c}') = 2 * |\vec{c}|$.
This is the normal electrical effect between two resting charges. It always consists of the effects of the field and of the anti-field, in principle.

We now will look at the case that $\varphi \neq 0$, with $\vec{V}_E = 0$. This is represented in Figure 3.
The effect of $\vec{W}$ in the direction of $\vec{c}$ is $\vec{W}_{//} = \vec{c}$, and the effect of $\vec{W}$ vertically to $\vec{c}$ is $\vec{W}_\perp = -\vec{V}_Q$.
We also get correspondingly: $\vec{W}'_{//} = -\vec{c}' = \vec{c}$ and $\vec{W}'_\perp = -(-\vec{V}_Q) = +\vec{V}_Q$.
This means: $\vec{W}_\perp$ and $\vec{W}'_\perp$ abolish each other, while we get $\vec{W}_{//} + \vec{W}'_{//} = 2 * |\vec{c}|$.

Initially we had the problem that there was an effect vertically to $\vec{c}$ caused by φ. We recognize here now that the problem is solved by the anti-field because the two components of the field and of the anti-field which are vertically to $\vec{c}$ abolish each other exactly. Additionally, the two components parallel to $\vec{c}$ of the field and of the anti-field yield exactly the normal electrical effect.

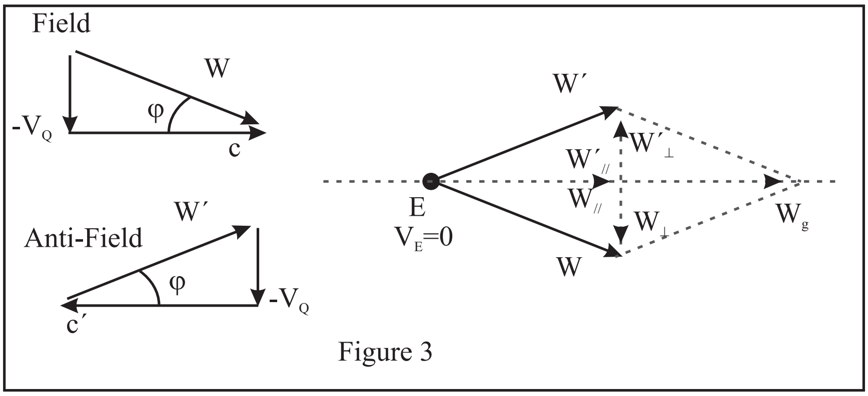

Figure 3

Until now we have had $\vec{V}_E = 0$. When the charge E, on which a field has an effect, moves with the velocity $\vec{V}_E$ ($\vec{V}_E \neq 0$), then a magnetic effect arises, if also $\vec{V}_Q \neq 0$, therefore if $\varphi \neq 0$. In the following I will show how the magnetic effect arises from $\vec{V}_E$ and φ.

4. The magnetic effect

We remember: At the creation of the field of a charge Q the velocity $\vec{V}_Q$ of the charge had to be taken into account. The effect $\vec{W}$ of the field is represented by $\vec{V}_Q$ and $\vec{c}$.

In an analogous way the velocity $\vec{V}_E$ of the charge E, on which the field has an effect, also must be taken into account.
At this it is of decisive importance to pay attention to the correct application of the signs.
Another important point is the quantization of the effect of the field on the charge.

4.1 Parallel velocities

We want to approach gradually to the conditions. To this purpose we look at first at a simple case: the field producing charge Q, which moves with $\vec{V}_Q \neq 0$, and the charge E, on which the field has an effect and which moves with $\vec{V}_E \neq 0$, move on the same straight line. This can be seen in Figure 4.

4.1.1 Signs

We have already seen that the effect (or the field-strength) of the field of Q doesn't change by $\vec{V}_Q$ in the direction of $\vec{V}_Q$. Only the quantization changes.
So, in the direction of $\vec{V}_Q$ the effect $\vec{W}$ of the field can be represented by $\vec{c}$. ($\vec{W}_Q \mathrel{\hat{=}} \vec{c}$)

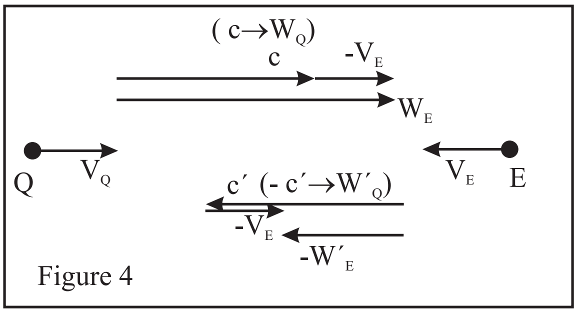

Figure 4

In a corresponding way the effect $\vec{W}'$ of the anti-field can be represented by $-\vec{c}'$ since the field and the anti-field act exactly equally strong. ($\vec{W}'_Q \mathrel{\hat{=}} -\vec{c}'$) (Remember: $\vec{c}'$ points in the opposite direction to $\vec{c}$, but the anti-field acts in the opposite direction to the field. For this reason the "-" is necessary in front of $\vec{c}'$.)

Very analogous to this that the field changes by $\vec{V}_Q$ at its emergence on Q, now the effect of the field on E shall change by $\vec{V}_E$, too.
The effect of the field on E changes by $\vec{V}_E$ in the following way:

When E moves towards Q, which means that $\vec{c}$ and $\vec{V}_E$ point in opposite directions, then the effect extends by the amount of $\vec{V}_E$ since here E moves towards the field. When $\vec{c}$ and $\vec{V}_E$ point in the same direction, then the effect reduces by the amount of $\vec{V}_E$ since here E runs away from the field.
So we get:

$$\vec{W}_E = \vec{c} + (-\vec{V}_E)$$

$$\vec{W}_E' = -(\vec{c}\,' + (-\vec{V}_E)) = -(-\vec{c} + (-\vec{V}_E))$$

Therefore: $\vec{W}_E + \vec{W}_E' = \vec{c} - \vec{V}_E + \vec{c} + \vec{V}_E = 2 * \vec{c}$

We recognize here that the effect-changes which arise by $\vec{V}_E$ at the field and at the anti-field abolish each other exactly. Exactly the normal electrical effect arises resulting. (In this simple case described here.)

4.1.2 Quanta

How does it behave with the quanta?
We had noticed that the quantization of the field depends on $\vec{V}_Q$. A (one-dimensional) length ΔS had been assigned to every quantum. The ΔS moves with the speed $\vec{c}$. The time, which E needs to pass through ΔS, changes by $\vec{V}_E$, of course (in Figure 4, it gets smaller). Consequently, one could think now that the number of the quanta which have an effect on E changes by $\vec{V}_E$. But this isn't so.
Here it is necessary to take the following into account: a quantum is defined by its effect or by its energy-transfer. But the effect of a quantum always consists of the addition of the effects of the quantum *plus* that one of the anti-quantum. The anti-quantum in turn moves in an opposite direction to the quantum.
So, the effect or the energy-transfer to E in a time unit Δt_0 arises from the addition of the quanta plus the anti-quanta. Since the effect of the anti-quanta *changes* by $\vec{V}_E$ in exactly the opposite way as the effect of the quanta do, the same overall-effect (W_g) always results after the time Δt_0, independently of $\vec{V}_E$.
So, the number of the quanta (W_g) which have an effect on E is independent of $\vec{V}_E$. Of course this is valid in particular if $\vec{V}_E \perp \vec{c}$.

Every quantum always becomes a quantum and an anti-quantum. This means that both the number of the quanta and that of the anti-quanta doesn't change by $\vec{V}_E$.
Every quantum or anti-quantum of the field of Q can be represented by $\vec{c}$ or $-\vec{c}\,'$.
The effect of every quantum or anti-quantum changes correspondingly because of $\vec{V}_E$ by $\vec{c} + (-\vec{V}_E)$ or $-(\vec{c}\,' + (-\vec{V}_E))$.
This corresponds exactly to the conditions which one also finds at the considerations about the field.

Remark: For having the same conditions for the field as for the quanta in this simple way it is decisive that the number of the quanta doesn't change by $\vec{V}_E$. If one liked to regard the emergence of the anti-field as a *reflection*, then the numbers of the quanta change by $\vec{V}_E$, what can lead to very complicated conditions. This isn't made in this work here.

The analysis of the quanta can be renounced in the following. Instead, it suffices to look at the field and at the anti-field.

4.2 General case

We have seen until now:
As long as Q and E move on the same straight line, no additional effect to the normal electrical effect arises, therefore there is no magnetic effect.
Such an additional effect which corresponds to the magnetic effect arises only, if the field has the angle φ between its propagation-direction (with $\vec{c}$) and its effect-direction, and if E moves with a velocity $\vec{V}_E \neq 0$. It was already shown that the angle φ doesn't yield any additional effect to the normal electrical effect when $\vec{V}_E = 0$. It was already shown, too, in principle, that a $\vec{V}_E \neq 0$ with a $\varphi = 0$ doesn't yield any additional effect since a $\vec{V}_E \perp \vec{c}$ doesn't change the number of the quanta - this will get clearer in the considerations following now.

For the better understanding we approach the connections best by having first a look at two special cases, before we then *calculate* the general case in the next chapter.
The two special cases are:
1.) $\vec{V}_Q \perp \vec{c}$ and $\vec{V}_E // \vec{c}$
2.) $\vec{V}_Q \perp \vec{c}$ and $\vec{V}_E \perp \vec{c}$

But at first, I describe the general procedure (without calculations), before I then will apply this procedure to these two special cases.

4.2.1 General procedure

As long as Q and E, or $\vec{c}$ and $\vec{V}_E$, were moving only on the same straight line, the meaning of $\vec{V}_E$ could be understood easily.
But as soon as the angles φ results for the effect-direction by $\vec{V}_Q \perp \vec{c}$, it is very important to use the $\vec{V}_E$ correctly.
First it makes sense to represent the $\vec{V}_E$ by two components: one component parallel to $\vec{c}$, this is $\vec{V}_{E//}$, and one component vertical to $\vec{c}$, this is $\vec{V}_{E\perp}$.
For the component parallel to $\vec{c}$, this is $\vec{V}_{E//}$, it is in principle the same as in the case in which $\vec{c}$ and $\vec{V}_E$ are on the same straight line. But here, though, Q moves with $\vec{V}_Q$ vertically to this straight line, so that for $\vec{W}$ the angle φ arises. Therefore the $\vec{V}_{E//}$ is added to $\vec{c}$ so that $\vec{W}$ changes correspondingly. At this, the effect-*change* $\Delta\vec{W}$ has the same angle as $\vec{W}$.
This is represented in Figure 5 for a $\vec{V}_{E//}$ which points in an opposite direction to $\vec{c}$ so that the effect $\vec{W}$ gets *greater* by the amount $\Delta\vec{W}$.
Remember: if $\vec{V}_E$ and $\vec{c}$ point in opposite directions, then the effect enlarges, and if $\vec{V}_E$ and $\vec{c}$ point in the same direction, then the effect reduces. This is valid too, of course, when the effect $\vec{W}$ has an angle φ to $\vec{c}$.

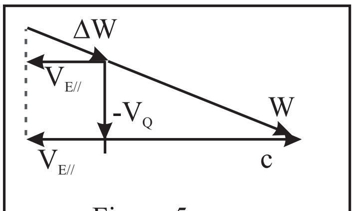

Figure 5

For the anti-field it is also the same, of course, in an analogous way. But for the anti-field the $\vec{c}'$ is taken instead of $\vec{c}$ since the anti-field moves with $\vec{c}'$ (in an opposite direction to $\vec{c}$). So, when $\vec{V}_E$ and $\vec{c}'$ point in opposite directions, then the effect $\vec{W}'$ of the anti-field gets greater. Here it is necessary to take into account that the anti-field acts resulting in the same direction as

the field since its actually opposite effect-direction is cancelled out by its opposite movement-direction. So, when the $\vec{V}_E$ and the $\vec{c}'$ point in opposite directions, then the $\Delta\vec{W}'$ has the same direction as the $\vec{W}'$. And finally, when $\vec{V}_E$ and $\vec{c}'$ point in the same direction, then the $\vec{W}'$ gets smaller.
Said briefly: for the field and the anti-field it is always: if E moves toward a field, then the effect gets greater, and if E co-moves with a field, then the effect gets smaller.
So, the component parallel to $\vec{c}$ causes an additional effect (with signs) in the direction of $\vec{W}$ (or $\vec{W}'$). So, an additional effect arises parallel to $\vec{W}$.

For the component of $\vec{V}_E$ which is vertically to $\vec{c}$ (this is $\vec{V}_{E\perp}$) it is a little different. The $\vec{V}_{E\perp}$ causes an effect *of its own* which is vertically to the effect $\vec{W}$ (or $\vec{W}'$). That the $\vec{V}_{E\perp}$ causes an effect of its own is logical since the field doesn't have any effect vertically to $\vec{W}$ yet. We have already noticed that the effect of the field arises by the velocity with which the field leaves Q. And a corresponding additional effect arises from $\vec{V}_Q$. So, the $\vec{V}_{E\perp}$ also will cause an additional effect vertically to $\vec{W}$.
The $\vec{V}_{E//}$ strengthens or weakens an already existing effect. For the $\vec{V}_{E\perp}$ the effect arises from the field to which its relative motion is. It has to be taken into account that $-\vec{V}_{E\perp}$ must be taken for the anti-field. It is clear that for the effect-direction of the additional effect, which arises from $\vec{V}_{E\perp}$, the effect-direction of the field, relatively to which the $\vec{V}_{E\perp}$ is regarded, must be taken. And the anti-field acts in an opposite direction to the field. But differently than at $\vec{V}_{E//}$ the opposite effect-direction of $\vec{V}_{E\perp}$ *is not* abolished by an opposite motion-direction.
So, a new additional effect $\Delta\vec{W}_\perp$ arises by $\vec{V}_{E\perp}$ for which the φ of the field has to be taken into account likewise. Therefore the $\Delta\vec{W}_\perp$ is vertically to $\vec{W}$. In Figure 6 this is represented for the field $\vec{W}$. For the anti-field $\vec{W}'$ the $-\Delta\vec{W}_\perp'$ has to be taken.

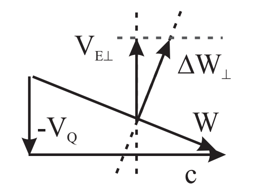

Figure 6

Still a word about the representation: as long as $\varphi = 0$, it sufficed to represent the effect of the field simply by $\vec{c}$. This was so because although a velocity of Q in the direction of $\vec{c}$ (with $\vec{V}_{Q\perp} = 0$) changed the kind of the quantization it did not change the strength of the field. There wasn't any additional effect (as already stated). But when there is an angle $\varphi \neq 0$, then the effect must be represented by the vectorial addition of $\vec{c}$ and $-\vec{V}_Q$, because here the $\vec{V}_Q$ causes an *additional* effect. Taken exactly, this additional effect (that is the angle φ) arises by the component of $\vec{V}_Q$ which is vertically to $\vec{c}$, this is $\vec{V}_{Q\perp}$. I will say something more about that later.

For the clarification we will now apply the described procedure to the two mentioned special cases.

1.) $\vec{V}_Q \perp \vec{c}$ and $\vec{V}_E // \vec{c}$ (Figure 7a)
Since $\vec{V}_E // \vec{c}$, it is $\vec{V}_{E\perp} = 0$ and $\vec{V}_E = \vec{V}_{E//}$. The effect-changes, which arise from $\vec{V}_E = \vec{V}_{E//}$, are represented in Figure 7b. For the field this is $\Delta\vec{W}$ and for the anti-field it is $\Delta\vec{W}'$.
Since $\vec{V}_{E//}$ moves towards $\vec{c}$, the $\Delta\vec{W}$ points in the same direction as the $\vec{W}$.
Since $\vec{V}_{E//}$ runs away from $\vec{c}'$, the $\Delta\vec{W}'$ points in the opposite direction as the $\vec{W}'$.

The amounts of $\left|\Delta\vec{W}\right|$ and $\left|\Delta\vec{W}'\right|$ are equally big. The addition of $\Delta\vec{W}$ and $\Delta\vec{W}'$ yields $\Delta\vec{W}_r$.

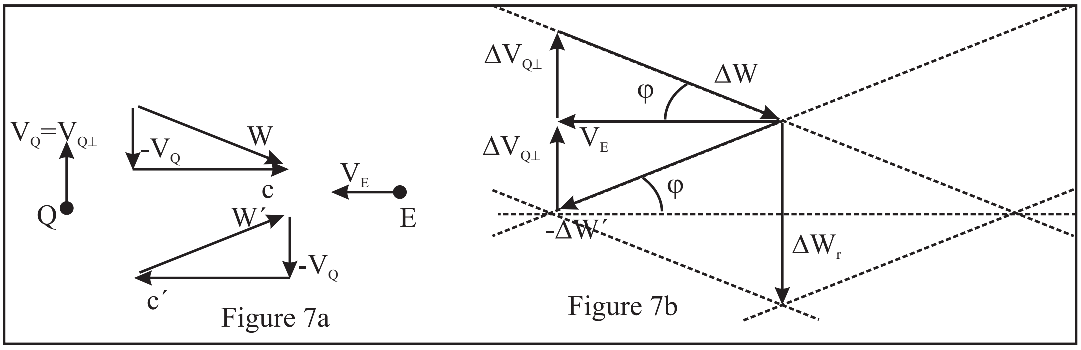

Figure 7a
Figure 7b

If one looks at Figure 7b, one already recognises only and alone by the geometry, without carrying out any calculations, that $\Delta\vec{W}_r$ is vertically to $\vec{V}_E$.

An effect-change in the direction of $\vec{V}_E$ (therefore parallel to $\vec{V}_E$) doesn't arise.

In the Figure 7b I have labelled the perpendicular to $\vec{V}_E$ to be $\Delta\vec{V}_{Q\perp}$. It is:

$$\frac{V_{Q\perp}}{c} = \frac{\Delta V_{Q\perp}}{V_E} \Rightarrow \Delta\vec{V}_{Q\perp} = \frac{V_{Q\perp} * V_E}{c}.$$

One recognises in Figure 7b that: $\Delta W_r = 2 * \Delta V_{Q\perp} = 2 * \dfrac{V_{Q\perp} * V_E}{c}$.

I will show the exact calculations in the next chapter, just at the calculation of the general case. Later on it will get clear, that the $\Delta\vec{W}_r$ actually corresponds exactly to the magnetic effect. This example here is primarily for the illustration.

The second special case which had to be regarded is:
2.) $\vec{V}_Q \perp \vec{c}$ and $\vec{V}_E \perp \vec{c}$ (Figure 8a)

Since $\vec{V}_E \perp \vec{c}$, it is $\vec{V}_{E//} = 0$ and $\vec{V}_{E\perp} = \vec{V}_E$.

Here, the $\vec{V}_E = \vec{V}_{E\perp}$ causes its own effect and that effect is vertically to $\vec{W}$ and vertically to $\vec{W}'$, therefore it is in the directions $\vec{W}_\perp$ and $\vec{W}'_\perp$ (Figure 8b). I label these two effects also with a "Δ" (therefore they are $\Delta\vec{W}_\perp$ and $\Delta\vec{W}'_\perp$) since they also represent a change, compared with the situation in which $\vec{V}_E = 0$.

The effect in the direction of $\vec{W}_\perp$ keeps its sign while the anti-field ($\vec{W}'_\perp$) acts in the opposite direction.

One immediately recognizes here, too, that $\Delta\vec{W}_r$ is vertically to $\vec{V}_E$. In addition, we get here also:

$$\Delta W_r = 2 * \frac{V_{Q\perp} * V_E}{c}.$$

This two special cases here have shown in a graphic way that the principle works since an arbitrary $\vec{V}_E$ can always be represented by the components $\vec{V}_E // \vec{c}$ and $\vec{V}_E \perp \vec{c}$.

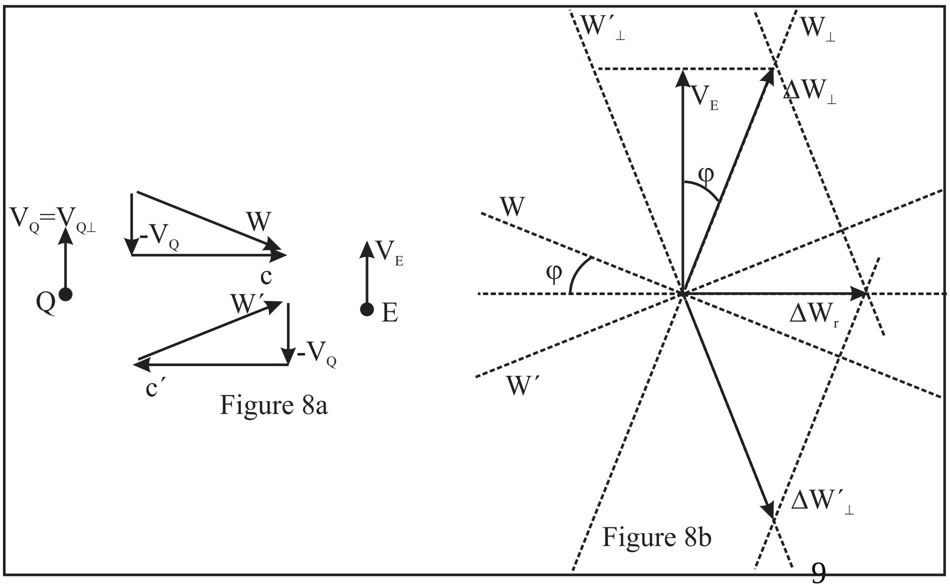

Figure 8a
Figure 8b

There was the question whether an additional effect arises additionally to the normal electric effect if $\varphi = 0$ (therefore $\vec{V}_Q = 0$) while E moves with $\vec{V}_E \neq 0$. One recognises very well at these two examples (special cases) that for $\varphi = 0$ the components of $\vec{V}_E$ of the field and of the anti-field always cancel each other out exactly. So, a $\vec{V}_E$ alone (that is with $\varphi = 0$ or $\vec{V}_Q = 0$) doesn't cause any additional effect.

5. Calculations of the general case

Before, now, the general calculations can be carried out, two facts still must be cleared:
1.) Reflection and 2.) The meaning of $\vec{V}_{Q\perp}$

5.1 About 1.) (Reflection)
When the field acts on the charge E, then it moves with the speed $\vec{c}$ over E. When E moves with the velocity $\vec{V}_E$, then $\vec{V}_E$ can be represented by two components: one component parallel to $\vec{c}$, this is $\vec{V}_{E//}$, and one component vertical to $\vec{c}$, this is $\vec{V}_{E\perp}$.
For the effect-change which arises by $\vec{V}_{E//}$ it suffices to simply add the $\vec{V}_{E//}$ to the $\vec{c}$.
Vertically to $\vec{c}$, the field doesn't has a velocity. Such a velocity arises from $\vec{V}_{E\perp}$. The effect, which arises from that, corresponds to the velocity, with which *the field* moves over E in this direction. This velocity is $-\vec{V}_{E\perp}$. So, the $-\vec{V}_{E\perp}$ must be used and not the $\vec{V}_{E\perp}$.
From $\vec{V}_{E//}$ and $-\vec{V}_{E\perp}$, the reflection of $\vec{V}_E$ from $\vec{c}$ arises. (In other words: having $\vec{V}_{E//}$ and $-\vec{V}_{E\perp}$ corresponds to a reflection of $\vec{V}_E$ from $\vec{c}$. So, the reflection of $\vec{V}_E$ from $\vec{c}$ has to be used.)
The effects (or the effect-changes), therefore the signs, shall be determined only *after* $\vec{V}_E$ is reflected from $\vec{c}$.
I mention here, once again, that $\vec{c}\,'$ always points exactly in the opposite direction to $\vec{c}$. Since, therefore, $\vec{c}$ and $\vec{c}\,'$ are parallel, it does not matter whether $\vec{V}_E$ is reflected from $\vec{c}$ or from $\vec{c}\,'$.

Remark: In the two special cases of the previous chapter ($\vec{V}_Q \perp \vec{c}$ with $\vec{V}_E // \vec{c}$, and $\vec{V}_Q \perp \vec{c}$ with $\vec{V}_E \perp \vec{c}$) the problem with the reflection hadn't stood out due to the symmetry; however, one should carry out the reflection nevertheless to get correct signs always.
The reflection of $\vec{V}_E$ from $\vec{c}$ takes place independently of φ (therefore $\vec{V}_Q$), of course.

The second fact, which I mentioned at the beginning of this chapter, still must be cleared now:

5.2 About 2.) (The meaning of $\vec{V}_{Q\perp}$)

Generally there is an angle between the velocity $\vec{V}_Q$ of the charge Q and the speed $\vec{c}_E$ (the speed of light) of the field in the direction of E (see Figure 9), this is the angle α. So, one can now represent $\vec{V}_Q$ by two components: one in the direction of $\vec{c}_E$, this is $\vec{V}_{Q//}$, and one vertical to $\vec{c}_E$, this is $\vec{V}_{Q\perp}$.

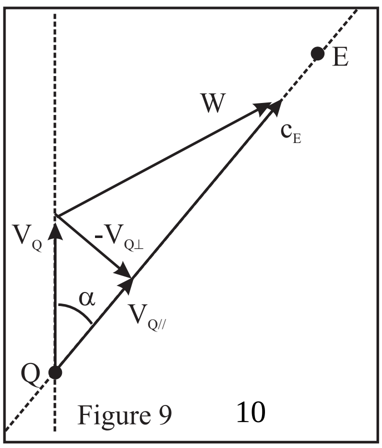

Figure 9

For the component $\vec{V}_{Q//}$ it is $\varphi = 0$. This means that by $\vec{V}_{Q//}$ no effect-change takes place. The effect of the field doesn't change by $\vec{V}_{Q//}$. So the $\vec{V}_{Q//}$ can be ignored.

For the $\vec{V}_{Q\perp}$ it is different. The $\vec{V}_{Q\perp}$ changes the effect of the field exactly by the amount to which the $\vec{V}_{Q\perp}$ corresponds. The effect of the field ($\vec{W}$) results from the addition of $\vec{c}$ plus $-\vec{V}_{Q\perp}$.

The direction of the effect $\vec{W}$ arises exclusively from $\vec{V}_{Q\perp}$ and $\vec{c}$. The $\vec{V}_{Q//}$ doesn't influences the direction of $\vec{W}$ just as it doesn't influences the amount of $\vec{W}$.

5.3 Calculation of the general case

Now we can carry out the general calculation.

First, $\vec{V}_E$ is reflected from $\vec{c}$. This yields $|\vec{V}_E$ (the vertical line besides $\vec{V}_E$ shall symbolize $\vec{V}_E$-reflected).

Then the $\vec{V}_E$ is represented by its components parallel and vertical to $\vec{c}$, these are $\vec{V}_{E//}$ and $\vec{V}_{E\perp}$.

From this representation the effect-components to the field, these are $\Delta\vec{W}$ and $\Delta\vec{W}_\perp$, and these to the anti-field, these are $\Delta\vec{W}'$ and $\Delta\vec{W}'_\perp$, yield.

Then the signs of the effect-changes have to be determined.

For $\Delta\vec{W}_\perp$ and $\Delta\vec{W}'_\perp$ this is easy. The $\Delta\vec{W}_\perp$ keeps its sign, and for the anti-field the $-\Delta\vec{W}'_\perp$ must be taken.

For $\Delta\vec{W}$ and $\Delta\vec{W}'$ it is exactly the opposite: The $\Delta\vec{W}'$ keeps its sign and for the field the $-\Delta\vec{W}$ is taken. This is explained as follows: The direction of $\vec{c}$ is defined as the positive direction. If $\vec{c}$ and $\vec{V}_{E//}$ point in the same direction, then this weakens the effect, therefore $-\Delta\vec{W}$ must be taken. If $\vec{c}$ and $\vec{V}_{E//}$ point in opposite directions, then this strengthens the effect. But here the $\vec{V}_{E//}$ is negative. This would yield a weakening of the effect. So, $-\Delta\vec{W}$ must be taken again.

Similar considerations apply to the anti-field. But it has to be taken into account that $\vec{c}'$ is negative here while the anti-field acts in the same direction as the field. This abolishes each other so that $+\Delta\vec{W}'$ must be taken.

At next, the effect-components ($\Delta\vec{W}$, $\Delta\vec{W}_\perp$, $\Delta\vec{W}'$ and $\Delta\vec{W}'_\perp$) are analysed once more and represented by components, too. We want to know, whether an effect arises (by $\vec{V}_E$) in the direction of $\vec{V}_E$ (therefore parallel to $\vec{V}_E$). In addition, we want to know how great the effect is vertically to $\vec{V}_E$. Therefore

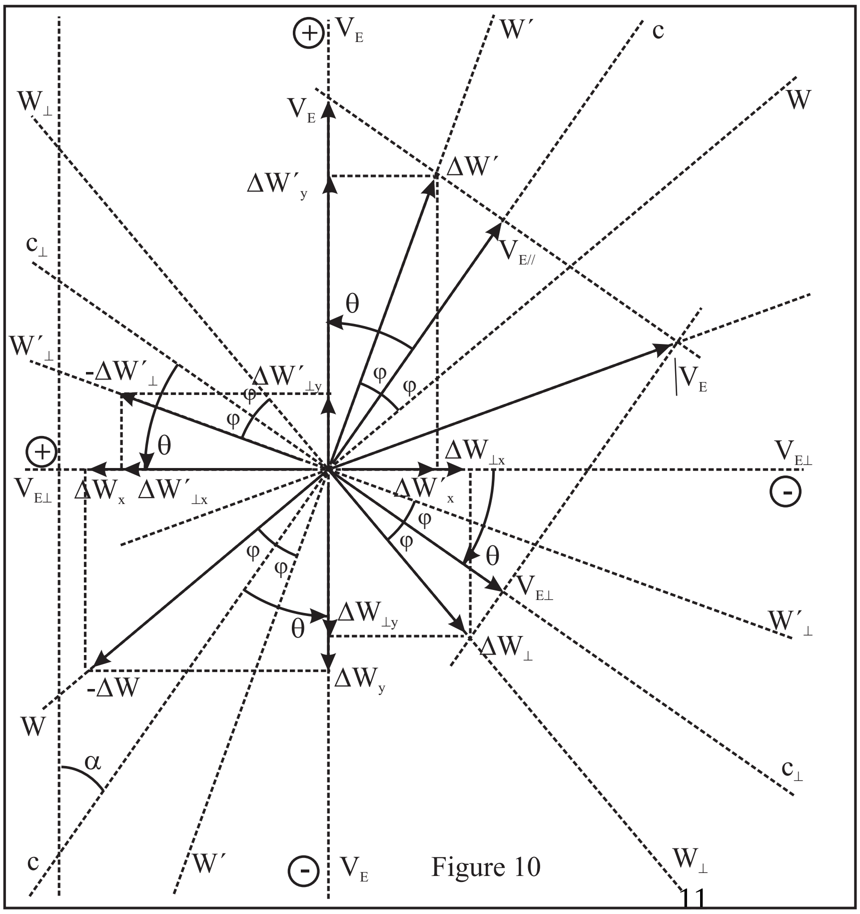

Figure 10

we represent the effect-components by components vertically to $\vec{V}_E$, this are $\Delta\vec{W}_x$, $\Delta\vec{W}_{\perp x}$, $\Delta\vec{W}'_x$ and $\Delta\vec{W}'_{\perp x}$, and by components parallel to $\vec{V}_E$, this are $\Delta\vec{W}_y$, $\Delta\vec{W}_{\perp y}$, $\Delta\vec{W}'_y$ and $\Delta\vec{W}'_{\perp y}$.
These steps are carried out in Figure 10.
The straight lines W and W' (dotted lines) are the effect-directions of the field and of the anti-field. The straight lines $W_\perp$ and $W'_\perp$ are the lines vertical to W and to W'. The straight line $V_{E\perp}$ (dotted line, not to be mistaken for the velocity $V_{E\perp}$, which is vertically to $\vec{c}$) is the vertical direction to $\vec{V}_E$. The straight line $c_\perp$ is the vertical direction to $\vec{c}$.

We define the direction of $\vec{c}$ as the positive direction. This is the simplest. The signs of the $\Delta\vec{W}_x$, $\Delta\vec{W}_{\perp x}$, $\Delta\vec{W}'_x$, $\Delta\vec{W}'_{\perp x}$, $\Delta\vec{W}_y$, $\Delta\vec{W}_{\perp y}$, $\Delta\vec{W}'_y$ and $\Delta\vec{W}'_{\perp y}$ yield correspondingly.

The angle θ is the angle *from* $\vec{c}$ *to* $\vec{V}_E$ (take into account the sign). The correct signs of the effect-components parallel and vertical to $\vec{V}_E$ arise from the correct ascertainment of the angles (with signs) of these components. (As an alternative, one can simply always calculate with the amounts and then gather the correct signs from the Figure 10.)
It is:

$$\cos\theta = \frac{V_{E//}}{V_E} \Rightarrow V_{E//} = V_E * \cos\theta$$

$$\cos\theta = \frac{V_{E\perp}}{V_E} \Rightarrow V_{E\perp} = V_E * \sin\theta$$

By the reflection of $\vec{V}_E$ we get:

$$V_{E\perp} = -V_E * \sin\theta$$

The angle between $\vec{V}_{E//}$ and $\vec{c}$ is zero.
The angle between $V_{E\perp}$ and $\vec{c}$ is 90°.
The angle between $-V_{E\perp}$ and $\vec{c}$ is 270°.
We also have:

$$\cos\varphi = \frac{V_{E\perp}}{\Delta W_\perp} \Rightarrow \Delta W_\perp = \frac{V_{E\perp}}{\cos\varphi} = \frac{V_E * si\theta}{\cos\varphi}$$ The angle to $\vec{c}$ is $270-\varphi$.

$$\cos\varphi = \frac{V_{E\perp}}{\Delta W'_\perp} \Rightarrow \Delta W'_\perp = \frac{V_{E\perp}}{\cos\varphi} = \frac{V_E * si\theta}{\cos\varphi}$$ The angle to $\vec{c}$ is $270+\varphi$.

The amounts of $\Delta W_\perp$ and $\Delta W'_\perp$ are equally grate. For the ascertainment of the angle, the $-V_{E\perp}$ must be taken. (From this the angle of 270° to $\vec{c}$ arises.) Between $\vec{c}$ and $\vec{W}$ the angle is $-\varphi$, and between $\vec{c}$ and $\vec{W}'$ the angle is $+\varphi$. This means correspondingly that here also the $-\varphi$ must be added to $\Delta\vec{W}_\perp$, and the $+\varphi$ must be added to $\Delta W'_\perp$.

For (instead of) the $\Delta W'_\perp$ the $-\Delta\vec{W}'_\perp$ must be taken, as already explained. Therefore +180° must be added. Therefore we have:
For $\Delta W'_\perp$ the angle is: $270° + \varphi + 180° = 360° + 90° + \varphi = 90° + \varphi$.

Furthermore we have:

$$\cos\varphi = \frac{V_{E//}}{\Delta W} \Rightarrow \Delta W = \frac{V_{E//}}{\cos\varphi} = \frac{V_E * \cos\vartheta}{\cos\varphi}$$ The angle to $\vec{c}$ is $-\varphi$.

$$\cos\varphi = \frac{V_{E//}}{\Delta W'} \Rightarrow \Delta W' = \frac{V_{E//}}{\cos\varphi} = \frac{V_E * \cos\vartheta}{\cos\varphi}$$ The angle to $\vec{c}$ is $+\varphi$.

The amounts of ΔW and $\Delta W'$ are equally grate. For the ascertainment of the angles the $+\vec{V}_{E//}$ must be taken.
For (instead of) the ΔW the $-\Delta W$ must be taken, as already explained. Therefore +180° must be added. Therefore we have:
For ΔW the angle is $+180° - \varphi$.

Now the components parallel (W_y, W'_y, $W_{\perp y}$ and $W'_{\perp y}$) and vertical (W_x, W'_x, $W_{\perp x}$ and $W'_{\perp x}$) to $\vec{V}_E$ will be ascertained. Here, the correct angles must be used directly.
The ascertained angles, though, refer to $\vec{c}$ while we want to ascertain the components referring to $\vec{V}_E$ or $V_{E\perp}$.
Between $\vec{c}$ and $\vec{V}_E$ the angle is θ. This angle still must be subtracted from the ascertained angles. Doing so, one gets the angles related to $\vec{V}_E$. We know from the trigonometrical functions:
The cosine of these angles are parallel to $\vec{V}_E$, and the sine of these angles are vertically to $\vec{V}_E$.
So, for the direction parallel to $\vec{V}_E$ we get:

$$\cos(180 - \varphi - \vartheta) = \frac{\Delta W_y}{\Delta W} \Rightarrow \Delta W_y = \Delta W * \cos(180 - (\varphi + \vartheta)) = -\Delta W * \cos(\varphi + \vartheta)$$

$$\cos(+\varphi - \vartheta) = \frac{\Delta W'_y}{\Delta W'} \Rightarrow \Delta W'_y = \Delta W' * \cos(\varphi - \vartheta)$$

$$\cos(270 - \varphi - \vartheta) = \frac{\Delta W_{\perp y}}{\Delta W_\perp} \Rightarrow \Delta W_{\perp y} = \Delta W_\perp * \cos(270 - (\varphi + \vartheta)) = -\Delta W_\perp * \sin(\varphi + \vartheta)$$

$$\cos(90 + \varphi - \vartheta) = \frac{\Delta W'_{\perp y}}{\Delta W'_\perp} \Rightarrow \Delta W'_{\perp y} = \Delta W'_\perp * \cos(90 + (\varphi - \vartheta)) = -\Delta W'_\perp * \sin(\varphi - \vartheta)$$

These four parallel components are added. Before of that the ΔW, $\Delta W'$, $\Delta W_\perp$ and $\Delta W'_\perp$ are inserted. The overall-effect in the parallel direction, this is $W_{//g}$, yields:

$$W_{//g} = \frac{V_E}{\cos\varphi} * (-\cos\vartheta * \cos(\varphi + \vartheta) + \cos\vartheta * \cos(\varphi - \vartheta) - \sin\vartheta * \sin(\varphi + \vartheta) - \sin\vartheta * \sin(\varphi - \vartheta))$$

If the first term inside the bracket is added to the third, and the second is added to the fourth, we get:

$$W_{//g} = \frac{V_E}{\cos\varphi} * (\cos(\varphi) - \cos(-\varphi)) = \frac{V_E}{\cos\varphi} * 0 = 0.$$

As expected, no effect results in the direction of $\vec{V}_E$.

We calculate the sine for the direction vertical to $\vec{V}_E$ in the same way:

$$\sin(180-\varphi-\vartheta)=\frac{\Delta W_x}{\Delta W}\Rightarrow \Delta W_x=+\Delta W*\sin(\varphi+\vartheta)$$

$$\sin(+\varphi-\vartheta)=\frac{\Delta W'_x}{\Delta W'}\Rightarrow \Delta W'_x=+\Delta W'*\sin(\varphi-\vartheta)$$

$$\sin(270-\varphi-\vartheta)=\frac{\Delta W_{\perp x}}{\Delta W_\perp}\Rightarrow \Delta W_{\perp x}=-\Delta W_\perp*\cos(\varphi+\vartheta)$$

$$\cos(90+\varphi-\vartheta)=\frac{\Delta W'_{\perp x}}{\Delta W'_\perp}\Rightarrow \Delta W'_{\perp x}=+\Delta W'_\perp*\cos(\varphi-\vartheta)$$

These four vertical components are added. Before of that the ΔW, $\Delta W'$, $\Delta W_\perp$ and $\Delta W'_\perp$ are inserted. The overall-effect in the vertical direction, this is $W_{\perp G}$, yields:

$$W_{\perp G}=\frac{V_E}{\cos\varphi}*(+\cos\vartheta*\sin(\varphi+\vartheta)+\cos\vartheta*\sin(\varphi-\vartheta)-\sin\vartheta*\cos(\varphi+\vartheta)+\sin\vartheta*\cos(\varphi-\vartheta))$$

If the first term inside the bracket is added to the third, and the second is added to the fourth, we get:

$$W_{\perp G}=\frac{V_E}{\cos\varphi}*(-\sin(-\varphi)+\sin(\varphi))=\frac{V_E}{\cos\varphi}*2*\sin(\varphi)=2*V_E*\frac{\sin\varphi}{\cos\varphi}$$

It is: $\frac{\sin\varphi}{\cos\varphi}=tag\varphi$. And as we know, it is: $tag\varphi=\frac{V_{Q\perp}}{c}$. Therefore the $W_{\perp G}$ yields to:

$$W_{\perp G}=+2*\frac{V_E*V_{Q\perp}}{c}$$

The positive sign means here that the angle *from* $\vec{V}_E$ *to* $W_{\perp G}\,//V_{E\perp}$ is +90°, in which the angle θ *from* $\vec{c}$ *to* $\vec{V}_E$ is also positive.

We recognize a resulting effect here which is *independent* of θ.

The $W_{\perp G}$ is proportional to $\vec{V}_E$ and to $\vec{V}_{Q\perp}$. This corresponds to the magnetic effect. In the following I will show exactly how this works.

But first something about the effect-direction: The angle between $\vec{V}_Q$ and $\vec{c}$ is α. We consider the case $\alpha=90°$ and $\vartheta=90°$. This means that $\vec{V}_Q$ and $\vec{V}_E$ are parallel and that they point in the same direction. In this case the $W_{\perp G}$ points exactly in the opposite direction to the $\vec{c}$. This means that the $W_{\perp G}$, which corresponds to the magnetic effect, points exactly in the opposite direction to the electric effect.

As already said repeatedly, the effects of the field and of the anti-field are added. In the direction of $\vec{c}$ the field and the anti-field act in the same direction. So, the normal electric effect (so e.g. at $V_E=V_Q=0$) can be represented by $F_E=2*c$. So, the normal electric effect is represented by the light speed.

The $W_{\perp G}$ is only a velocity in the end, too. But at its ascertainment the effect-directions $\vec{W}$ and $\vec{W}'$ had to be taken into account. So, we represent the magnetic effect by $W_{\perp G}$:

$$F_M = -W_{\perp G} = -2 * \frac{V_E * V_{Q\perp}}{c}$$

Here the minus must be taken now since it was noticed that the $W_{\perp G}$ counteracts the electric effect.
One can now represent the magnetic force in relation to the electric force:

$$\frac{F_M}{F_E} = \frac{-2 * \frac{V_E * V_{Q\perp}}{c}}{2 * c} = -\frac{V_E * V_{Q\perp}}{c^2} \Rightarrow F_M = -F_E * \frac{V_E * V_{Q\perp}}{c^2}$$

In the case that we have $\vec{V}_{Q\perp} = \vec{V}_Q = \vec{c}$ (at $\alpha = 90°$) and $\vec{V}_E = \vec{c}$ we get $F_M = -F_E$. This meets exactly the expectations. The magnetic effect abolishes the electric effect at the speed of light exactly.

Of course, the law of Coulomb applies to the normal electric force: $F_E = \frac{Q_Q * Q_E}{r^2} \varepsilon$ [4]. According to the nomenclature used in this work till now it would be: the Q_Q are the field producing charges, the Q_E is the charge on which the field has an effect, and r is the distance between these charges.

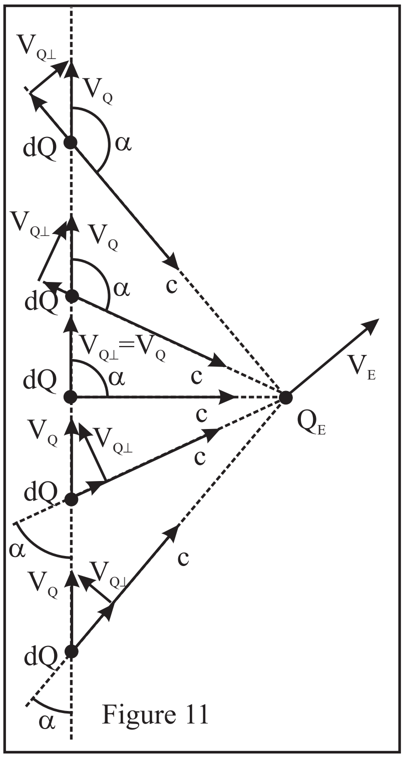

Figure 11

To find out the magnetic effect of a current (which flows along a wire) on a charge Q_E, it suffices to find out the electric effect and to multiply this electric effect with $-\frac{V_E * V_{Q\perp}}{c^2}$. Here, of course, we have:

$$\sin\alpha = \frac{V_{Q\perp}}{V_Q} \Rightarrow V_{Q\perp} = V_Q * \sin\alpha .$$

In the case of a straight wire (conductor) one simply would integrate over the angle α (this is indicated in Figure 11).

The magnitude of the magnetic force, found out here, depends, of course (!), on the observation location, therefore on the reference system. The magnetic force, found out here, depends on $\vec{V}_Q$ and on $\vec{V}_E$. The $\vec{V}_Q$ and $\vec{V}_E$ are observer dependent. The same also applies to the angle φ (as already mentioned). Different observers can observe different angles φ. The angle φ of the field is a field-characteristic which depends on the observer, it isn't independent of the observer. The transformations between the inertial systems are carried out normally via the special relativity. This applies to both to the forces (the magnetic and the electric forces), and to the speeds and angles (e.g. $\vec{V}_Q$, $\vec{V}_E$ and φ).

The angle φ depends on the reference system. Nevertheless, φ is a field-characteristic. I have shown in this work that φ suffices completely to explain the emergence of the magnetic effect. The magnetic effect arises from φ in a completely natural and automatic way. The only prerequisite is that the electric effect of the field arises from the velocity with which the field moves relatively to the field producing charge.

6. Electrodynamic processes

An important principle in this work is to represent the electric effect by the speed of light ($\vec{c}$). When the field producing charge Q moves with the velocity $\vec{V}_Q$, and when the charge E, on which the field has an effect, moves with the velocity $\vec{V}_E$, then the changes of the electric effect, which arise by these two velocities ($\vec{V}_Q$ and $\vec{V}_E$), are represented only by these two velocities.

When a charge E, on which a field has an effect, moves with the velocity $\vec{V}_E$, then the distance to the field producing charge (Q) changes by this velocity, and therefore the field-strengths (both the magnetic one and the electric one) also change. (For a current, that flows along a straight conductor, this doesn't has any meaning since there is the same charge always at every place (point) on the conductor.) Turned around it is exactly the same: if the charge E rests while the field-strength is changing, then this corresponds exactly to a motion of E relatively to the field producing charge. This means that a change of the field-strength corresponds to a virtual velocity of the charge E, this is $\vec{V}_{EV}$. This virtual velocity ($\vec{V}_{EV}$) of the charge E has the same meaning as $\vec{V}_E$. In exactly the same way in which the $\vec{V}_E$ can yield a magnetic effect, if the field has the angle φ, the $\vec{V}_{EV}$ can yield a magnetic effect also.

Both the electric and the magnetic field-strength can change. The special relativity must certainly be taken into account here.

The magnetic field-strength can change in different ways: the distance to the field-source changes, or the number of the charges which move changes, or the velocities ($\vec{V}_Q$) of the charges change. That last one means that φ changes. In each of these cases the *change* of the magnetic field corresponds to a virtual velocity ($\vec{V}_{EV}$) of the charge E. I mention this, to make clear that a change of the angle φ also corresponds to a $\vec{V}_{EV}$.

So, changes of the electric and magnetic field correspond to a virtual velocity $\vec{V}_{EV}$ of the charges on which the fields have an effect. The changes of the electric and magnetic field don't take place independently of each other. The special relativity has to be taken into account here. At next, different cases should be analysed now. This will not be done here. The important cognition which arises from the virtual velocity $\vec{V}_{EV}$ is the following: The principles of the electrodynamics are (of course) still valid completely independently from that that the emergence of the magnetic effect is described here by the angle φ. Said differently: The principles of the electrodynamics remain untouched from that that I explain the magnetic effect with the help of the angle φ.

The Maxwell equations [5] can be used exactly in the usual, hitherto way.

The arising of the electromagnetic waves also can be described as had. But, it has to be taken into account, though, that of course the electromagnetic waves contain the angle φ.

7. Closing remark

I could show that the emergence of the magnetic effect can be explained with the help of the angle φ. This is the way:

The normal electric effect is represented by the light speed $\vec{c}$. The light speed $\vec{c}$ is the velocity with which the electric field leaves its charge. Because of the velocity $\vec{V}_Q$, with which the field producing charge moves, the effect of the electric field changes. Because of the quantization of the electric field the effect of the electric field changes only vertically to $\vec{V}_Q$, namely by the angle φ. Because of the anti-field the effects of φ and φ´ (of the anti-field) abolish each other. Because of the velocity $\vec{V}_E$, with which the charge on which the field has an effect moves, a resulting effect arises, which is the magnetic effect. Because of the virtual $\vec{V}_E$, that is $\vec{V}_{EV}$, the principles of the electrodynamics yield (remain unchanged).

I think that the procedure shown here is plausible and justified. Most important of everything is the constancy of the light speed without which the magnetic effect couldn't be represented in the way shown here.
At next (in further works), I would like to apply the procedure shown here concretely to special electrodynamic processes.
In addition, I also would like to apply the procedure shown here to the gravitation.

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